DOCUMENT RESUME

ED 382 475 SE 056 284

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TITLE Establishing an Action Research Agenda for Preservice and Inservice Elementary Teacher Collaboration on Self-Empowerment in Science.
PUB DATE Apr 95
NOTE 13p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (San Francisco, CA, April 22-25, 1995).
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Action Research; *Educational Change; Elementary Education; Elementary School Teachers; Higher Education; *Inservice Teacher Education; *Partnerships in Education; *Preservice Teacher Education; Science Education; *Teacher Improvement; Undergraduate Study
IDENTIFIERS San Jose State University CA

ABSTRACT

This paper reports on the outcomes of an ongoing action research project with elementary teachers who are attempting to bring a science emphasis to their teaching and in which preservice teachers are matched with inservice teachers who are interested in improving their practice through a focus on science. The project is a modified version of a professional practice school that includes an emphasis on the improvement of professional practice and on teacher empowerment in science. The effort to move from a traditional university-driven model of professional development for preservice education to one that leads to teacher-driven, emancipatory practice at the classroom level began at San Jose State University in the fall of 1993. Changes since that time include: (1) establishment of a collaborative relationship among university faculty, student teachers, and classroom teachers that has resulted in a community of co-learners; and (2) efforts to move from research which is theory driven to theory-generating research. Results to date have implications for expectations of the amount of time necessary to effect local systemic change as well as the multiplicity of tasks at many levels that must be carried out, and confirm the value of long term investments of resources for reform agendas. Contains 19 references. (LZ)

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ED 382 475

Establishing an Action Research Agenda for Preservice and Inservice Elementary Teacher Collaboration on Self-Empowerment in Science

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Paper Presented at the National Association of Research in Science Teaching,
San Francisco, CA April 22-25, 1995.

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ABSTRACT

This paper reports on the outcomes of an ongoing action research project with elementary teachers who are attempting to bring a science emphasis to their teaching and in which preservice teachers are matched with inservice teachers who are interested in improving their practice through a focus on science. The project modifies the Holmes Group idea of a professional practice school (Holmes Group, 1990) to include an emphasis on the improvement of professional practice and on teacher empowerment in science. The effort to move from a traditional university-driven model of professional development for preservice education to one that leads to teacher-driven, emancipatory practice at the classroom level began at San Jose State University in the Fall of 1993. Since that time we have: (1) established a collaborative relationship among university faculty, student teachers, and classroom teachers that has resulted in a community of co-learners, and (2) explored how to move from research which is theory driven, to theory generating research, by developing strategies to move towards theory generating research (Carr & Kemmis, 1986). Results to date (1) have implications for expectations of the amount of time necessary to effect local systemic change as well as the multiplicity of tasks at many levels that must be carried out, and (2) confirms the value of long term investments of resources for reform agendas.

Creating A Collaborative Framework for Science Teacher Preparation

Science teaching preparation programs have increasingly become the focus of attention in the reform of science education (Yager, 1994). This reform may fail if we do not seriously examine our role as university science educators. The California State University System, which prepares 10 percent of the nation's teachers has recently been involved in such a project — the California State University Science Teaching Development Project (CSU-STDP). Given the diversity in science teacher preparation throughout the CSU System, this has resulted in many different agendas for action. This paper reports on an elementary science teacher preparation agenda ongoing at San Jose State University since the spring of 1993. It describes the process involved in the construction of a collaborative framework for elementary science education that links preservice and inservice education and within the context of a community of learners where university faculty and teachers are co-learners in the process. Any teacher preparation reform effort may fail if university educators do not seriously reflect on their role in the process.

Traditional teacher preparation programs have many limitations such as:

(1) being top down, with the university telling preservice/inservice teachers what to do,

(2) having its primary focus on serving the needs of preservice teachers,
(3) separating theory and practice, and
(4) providing limited opportunities for inservice teachers to be connected to a teacher preparation process which benefits their own development.

Such limitations has resulted in the need to create a teacher preparation program where we could:

(1) create a school-based, bottom up collaboration between university faculty and inservice teachers,
(2) explore professional development links between preservice and inservice science education,
(3) provide for field-based opportunities for the natural exploration of a blending of theory and practice, and
(4) involve inservice teachers in the professional development of preservice teachers, and at the same time create opportunities for their own professional development.

A major component of the vision which we adopted to achieve our objectives was the establishment of *elementary science emphasis sites* (Parsons, 1994). The Holmes Group promotes the idea of a professional practice school where teachers are actively engaged in the improvement of practice. SJSU wanted to explore the idea of the improvement of professional practice with science as a focus. At these sites university faculty and school personnel can collaboratively work towards improving practice and promoting self-empowerment of preservice and inservice elementary teachers in science, and, at the same time, create a new model for teacher preparation.

Recent science education research has focused heavily on inservice teachers improving their practice (Tobin, Davis, Shaw & Jakubowski, 1991), and in some cases preservice teachers (Abel & Roth, 1994; Martens, & Crosier, 1994). While such research has been respectful of teachers as professionals and sensitive to their needs, it has typically been theory driven, with the university science educator being in the position of power. This power imbalance has resulted in a lack of two-way reflection on practice. In response, Tippins, Nichols, & Tobin, 1993 talk about creating a community of learners where the university faculty would become co-learners. This paper attempts to critically reflect on our progress to date at creating such a community.

Making Sense of the Action Research Process

Action research in education is a term used to describe a family of activities in curriculum development, professional development, school improvement programs, and systems planning and policy development (Kemmis, 1982). The SJSU project involves all of these activities. These activities have in common the identification of strategies of planned action which are implemented, and then systematically submitted to observation,

reflection and change. Also, the participants in any given action are integrally involved in all of these activities. Lewin probably best summarizes action research when he describes it as consisting of analysis, fact finding, conceptualization, planning, execution, more fact-finding or evaluation, and then a repetition of this whole cycle of activities — indeed a spiral of such circles (Kemmis, 1982). It is the cycle of collaborative activities that this paper examines.

Before reviewing the collaborative activities associated with the SJSU project, it is important to consider the aims of action research. Grundy and Kemmis (1982) see action research as having two essential aims — to improve and to involve. Specifically, action research aims to improve in three areas: the practice, the understanding of the practice by its practitioners, and the situation in which the practice takes place. They also note that:

> The aim of involvement stands shoulder to shoulder with the aim of improvement. Action research is an inherently social form of research: those involved in the practice being considered are to be involved in the action research process in all its phases of planning, acting, observing and reflecting. As an action research project develops, it is expected that a widening circle of those affected by the practice will become involved in the research process. (p.84)

Since both aims (improvement and involvement) are integral parts of the project, we examine accomplishments as well as participation. Although the project involves activity at the state level, as part of the CSU science education reform movement, and at the university level, this report focuses on SJSU's relationship with teachers at the local school systems level.

When viewing the collaborative activities associated with the SJSU project as action researchers we are inevitably concerned with the politics and processes of innovation and change. Carr and Kemmis (1986) provide a useful interpretative framework for examining SJSU's action research agenda. They talk about technical, practical and emancipatory action research. This categorization provides a useful framework for the analysis of our action research accomplishments. For analysis purpose in this study they can be described as follows:

1. Technical Action Research
   Participants Roles - Facilitators have coopted practitioners into working on externally-formulated questions which are not based in their practical concerns.
   Focus of Research - It employs techniques to create and sustain the investigation of issues raised by outsiders, and it frequently concerns itself almost solely with the efficiency and effectiveness of practices in generating known outcomes.
   Type of Outcomes - It may lead to the improvement in practices from the viewpoint of the outsider, and frequently concerns itself almost

solely with the efficiency and effectiveness of practices in generating known outcomes.

2. Practical Action Research
   Participants Roles - Facilitators form cooperative relationships, helping them to articulate their own concerns, plan strategic action for change, monitor the problems and effects of changes actually achieved. Participants monitor their own educational practices with the aim of developing their practical judgment as individuals.
   Focus of Research - The facilitator's role is Socratic: to provide a sounding-board against which practitioners may try out ideas and learn more about the reasons for their actions, as well as learning more about the process of self-reflection.
   Type of Outcomes - Practical action research may be a stepping-stone to emancipatory action research in which participants themselves take responsibility for the Socratic role of assisting the group in its collaborative self-reflection.

3. Emancipatory Action Research
   Participants Roles - The practitioner group takes joint responsibility for the development of practice, understandings and situations, and sees these as socially-constructed in the interactive processes of educational life.
   Focus of Research - All groups assume equal status in the process
   Type of Outcomes - The critical impulse of research is towards the transformation of educational institutions is expressed not only in individual thinking, but in the common critical enterprise of changing selves in order to change the institutions those selves generate through their joint practices of communication, decision-making, work and social action.

Accomplishments reported in Tables 1 and 2 reflect the organization provided by these categories.

Phase I (Spring 93-94): Initiating a Collaborative Relationship

The first phase of our project involved initiating a collaborative relationship. Table 1 presents an analysis of the accomplishments using the categories of technical, practical and emancipatory, and level of activity (university and/or school) as a framework for analysis of the first phase of the project.

Table 1: Analysis of Phase I Accomplishments

1. **Type of Action:** Practical/Emanicpatory **Activity level:** University **Accomplishments:** The development of plans for a graduate level science education program. 1.01. The offering of two masters courses for elementary science education students in the Spring 94. 1.02. The development of a program proposal for a masters in teacher education with a science education concentration. 1.03. The development of plans for a graduate student science education seminar series to start in the Spring 1994. The goal is to establish a sense of science education community at the MA level.
2. **Type of Action:** Technical/Practical **Activity level:** University/School **Accomplishments:** The development of a futuristic vision for preservice /inservice elementary science education 2.01. Initiated a process to identify the essential elements which need to be incorporated into a course in elementary science education to give it a futuristic vision. 2.02. Established arrangements with a field site which will allow for the piloting of a student teaching component with a science emphasis.
3. **Type of Action:** Technical/Practical **Activity level:** University/School **Accomplishments:** The development of plans for inservice science education. 3.01. The submission of a grant proposals to prepare elementary science teachers at the inservice level. 3.02. The exploration of potential locations for the establishment of elementary science emphasis sites

4. **Type of Action:** Practical/Emanicpatory **Activity level:** University/School **Accomplishments:** The preparation of scholarly reports, presentations, and proposals on the outcomes/extension of project activity at SJSU. **4.01.** Action research components of the SJSU project will be reported at AETS (Association for the Education of Teachers in Science) and NARST(National Association for Research in Science Teaching) Conferences (Science Educator). **4.02.** Presentations at NSTA (National Association Science (Teachers). **4.03.** Received SJSU Innovation in Teaching and Learning Fellowship (Science Educator).
5. **Type of Action:** Technical **Activity level:** University **Accomplishments:** The establishment of a collaborative relationship with three science professors of undergraduate science courses for future outreach science education programs with elementary classrooms. **5.01** Development of a future plan of action - Phase II

Reflections on Phase I

The focus of the project in its initial stage, in the first year, was on teacher preparation, and as such it did little to create an emancipatory action research climate for the inservice teacher practitioners. However, we could not achieve a new model for science teacher preparation routed in practice without empowering teachers. It was evident that it would take extended time to establish an emancipatory action research climate at the classroom level. Carrying out such an agenda is a developmental process which needs time to mature. Also, it requires a shift from teachers *aiding* in the establishment of the science emphasis program (technical-practical) to the teachers *shaping* how such a program might develop (emancipatory). In addition, the activity must move from being *theory driven* to *theory generating* in its orientation. Moving towards theory generating action research at the practitioner level requires a greater participation by teachers.

Phase II (Fall '94-Spring '95): Establishing a Collaborative Relationship and a Community of Co-Learners

During the second phase of the project (Fall '94 - Spring 95), we saw the beginnings of both a collaborative relationship and a community of co-learners. Table 2 presents an analysis of the action research accomplishments, using the categories of technical, practical and emancipatory, and the level of activity as a basis for analysis.

Table 2: Analysis of Phase II Accomplishments

1. **Type of action:** Practical **Activity level:** University **Accomplishment:** A graduate level science education program. 1.01. Further offering of two masters courses for elementary science education students in the Spring 95. 1.02. Initiating a program proposal for a masters in teacher education with a science education concentration. 1.03. Continuation of graduate student science education seminar series.
2. **Type of action:** Technical to Emancipatory **Activity level:** University/School **Accomplishment:** The development of a futuristic vision for preservice /inservice elementary science education 2.01. Continued discussion of essential elements which need to be incorporated into a course in elementary science education to give it a futuristic vision. 2.02. Established arrangements with field sites for student teaching with a science emphasis. 2:03. Established student teacher as researcher projects as part of the student teaching experience. 2.04. Infused technology (e-mail, Kids-Net) into science emphasis student teaching and science methods classes. 2:05. Preservice teachers began participating in activities leading to a reflective practice. Video taping was used to facilitate the process. 2:06. Began collaborative planning with Milpitas Unified School District to develop a new model of professional development for preservice/inservice elementary teachers in science.

3. **Type of action:** Technical to emancipatory **Activity level:** University/school **Accomplishment:** The development of plans for inservice science education. 3.01. Continued exploration of potential locations for the establishment of elementary science emphasis sites 3:02. Established dialogue with school district for planning of co-learning activity 3:03 Initiated dialogue within College to review the masters program for inservice teachers.
4. **Type of action:** Practical to emancipatory **Activity level:** University/school **Accomplishment:** Continued the development of scholarly reports, presentations, and proposals based on the outcomes. 4.01. Action research components of the SJSU project reported at AETS (Association for the Education of Teachers in Science) and NARST(National Association for Research in Science Teaching) Conferences 4.02. Submitted proposal for Faculty Development Planning Grant to Explore the collaborative development of a model for teacher preparation in science (University/School District). 4.03. SJSU Innovation in Teaching and Learning Fellowship activity. 4:04. The funding of a CSU summer fellowship to focus on science emphasis student teaching.
5. **Type of action:** Technical/Practical **Activity level:** University **Accomplishment:** Continued collaboration with science professors of undergraduate science courses for future outreach science education programs in elementary classrooms. 5.01 Development of a future plan of action - Phase III

Reflections on Phase II

With the establishment of a science emphasis for student teaching ,the attempt to move towards greater teacher empowerment at the preservice/inservice levels has been initiated. We have learned that spreading the sites throughout districts is possible but to achieve in-depth collaboration we may have to limit our work primarily to one district. This is a difficult decision because we see promising undertakings happening across districts.

Our efforts has been primarily on the preservice component and the establishment of the idea of science emphasis sites. However, we now need to focus on defining inservice teachers' needs. A collaborative framework has begun but it is delicate. Efforts need to focus on the collaborative development of a future agenda based on common needs. Both the university and the schools share a common link in preservice education but we need to redefine this common ground. Inservice education also can have a shared focus at both the university and school levels. While we do not need to reach a consensus on these agendas it is possible to establish a common ground. Becoming co-learners in redefining teacher preparation, is part of professional life-long learning for all participants.

Planning for Phase III

Since we have just completed phase two of our project, we have yet to finalize the planning for the next phase. We have made significant gains in Phase II of this project, but recognize that our long term goal, to establish an emancipatory practice in the schools, will take a long time. Reflection (in, on, and away from the action) will contribute constructively to the next phase of planning.

Discussion: Challenges in Creating A New Vision for Teacher Preparation

Whenever the issue of inadequate instruction in science is discussed, elementary teachers often receive a major portion of the criticism. Such criticism has added to elementary teachers' viewing themselves as deficient. Most elementary teachers perceive themselves as being deficient particularly in science and have been conditioned to assume the fault is theirs. The result is that they are reticent to look externally for the cause of the problem. An alternate view would be that it is the science education of the elementary teachers that was deficient. Such a position calls for a different approach in elementary science education. Our approach is to involve teachers in understanding the nature of the construction of scientific knowledge and the acquisition of significant roles, such as teacher as researcher, experienced learner, and life long learner. Giving elementary teachers the opportunity to view the construction of knowledge differently provides an opportunity for a voice. Our strategy is to work towards collaborative emancipatory action research with elementary teachers who become interested in science because their voices need to be heard. This calls for a different approach in preservice/inservice elementary science education (Bearlin, 1990; Parsons 1992). We have just begun to construct a new vision which works toward self-empowerment of the elementary teachers in science. Our assumption is that through further collaborative efforts we can better understand some aspects of how to present an alternate image of science to elementary teachers; at the same time empower them to take action in their own teaching.

The employment of an emancipatory action research agenda carries with it a responsibility for transformative action. One of the aims is to empower ourselves and others by reflecting upon our experiences and to understand the factors influencing our agenda. Transformative research involves empowerment, by gaining an understanding about the forces acting to shape our practice. The next step would be to take action. Empowerment is viewed as being achieved when the actors are able to change their situation. It is hoped that the sharing of our project will be useful to others interested in the social and self-empowerment of teachers in science.

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